In the Context of Climate Variability, Assessing Trajectories from Eutrophication to Restoration Over 25 Years in the Tidal Freshwater Portion of the Potomac River Estuary

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As the second largest sub-estuary of the Chesapeake Bay and home to the United States' capital city, the Potomac River historically delivered tremendous nutrient loads to receiving waters of the Bay. This led to massive, pervasive summer algal blooms as far upstream as the tidal freshwater portion of the river. Nutrient management over the past 40 years led to remarkable decline in anthropogenic nutrient loads, despite burgeoning populations throughout the Washington DC metropolitan region. Over the period since 1984, a basin-wide phosphate detergent ban and costly nitrogen removal upgrades at the Chesapeake's largest wastewater treatment plant, Blue Plains, have created conditions for potential decline in water quality impairment. Meanwhile, inter-annual variability in hydrometerological conditions obscure underlying trends in recovery from eutrophication even in the upper tidal freshwater zone.

The current study examines 25 years of intensive water quality monitoring in the tidal Potomac River near Gunston Cove for signs of sustained water quality improvement. Visualization methods associated with exploratory data analysis are utilized to distinguish impacts of inter-annual climate variability and nutrient management factors. Results show an overall trajectory towards improved trophic status in recent years. Nonetheless, any sustained climatic change which creates longer, drier growing seasons could create conditions which once again favor massive algal blooms. Also discussed are implications for sustained monitoring of the river; implementation of new, ultra-advanced nitrogen removal at a Blue Plains, and development of climate-corrected trends in water quality in other embayments and coastal seas.

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